ign Strategies Maximize Energy Efficiency in Science Buildings

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ɔper Planning Results in Significant Cost Savings

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igning research facilities to operate at a maximum level of efficiency requires attention to special ures that can result in substantial savings in energy costs. The amount of energy needed to operate a may be five to 10 times higher than the usage required in an office building of similar size. By including cific design principles in the planning stages and using existing technology, new science buildings can ılt in a reduction of between 30 and 50 percent in energy costs.

Complete Story

is the first in a series of two articles about using proven planning strategies nhance operating efficiency and lower energy costs in research facilities. article discusses the first five of 10 design principles that can make a ificant difference in the operation of a research facility.

ɔording to research from the Environmental Protection Agency and the artment of Energy, there may be as much as $1 billion to $2 billion of energy savings possible in labs per year using existing technology," notes Joe ins, a partner at Zimmer Gunsul Frasca Partnership in Portland, Ore. search institutions looking to reduce their operating budgets and their ronmental footprint need to know what design strategies are going to get ı the best returns."

ı skyrocketing energy prices and an explosion in the construction of arch facilities, there is more pressure on institutions to implement ainable design features. Collins and Paul Mathew, a staff scientist at rence Berkeley National Laboratory, have created a list of Top 10 strategies ıded for use by building owners, architects, and engineers to affect cost ngs and energy efficiency.

strategies are already being used with success at facilities throughout the ed States, including Portland State University, Oregon Health and Science ersity, Duke University, Oregon State University, and the University of fornia at Berkeley and Santa Barbara.

ins and Mathew are including their strategies in the design of the Li Ka-Shing ter, a $150-million biomedical research laboratory building which will be structed at the University of California, Berkeley beginning in the spring of 3. It is imperative to include these strategies during the early design stages ause it is nearly impossible to implement them after a building is structed.

cus on Programming

first strategy involves programming, which represents the initial opportunity ıfluence operating costs. Each program has unique opportunities to explore ntial energy savings in areas such as program grouping/consolidation and recovery.

can be smarter about the buildings we design and we can achieve a more ainable outcome just by asking a few extra questions during programming," Collins. "Ask about the different types of spaces and which will have lar hours of operation, similar utility requirements, and similar need to ess daylight. We can then group spaces together that have similar uirements so we can be more efficient in our design."

planned Earth Systems Science Center at Oregon State University is an mple of how programming can be used to boost energy efficiency in other ects of the facility. The facility's massive data center, used to conduct anic and atmospheric research throughout the world, will produce a ıendous amount of heat. This energy will be used to heat other areas of the ding, such as the perimeter around the windows. The facility will also include e water tanks for testing remote submersible vehicles. A heat exchange ess will allow heat to be stored in the water tanks and then used elsewhere n necessary.

Biomedical Research Building at Oregon Health and Science University illustrates how effective programming can augment energy efficiency. Due steeply sloping site, most of the mechanical systems are located erneath the animal facility, which is on the first floor. Process wastewater ı the cagewash and other lab uses flows by gravity into a heat recovery tank then passes through a heat exchanger to preheat the incoming water for ıestic hot water and lab hot water.

yout Rationally

Biography

Joe Collins is a partner at the architectural firm of Zimmer Gunsul Frasca Architects LLP. During his 25 years of professional practice, he has developed an expertise in overseeing multidisciplinary teams working with multiple client user groups in a highly collaborative manner.

For more information

Click here to contact Joe Collins.

Fig. 3

Zone Appropriately

The Northwest Center for Engineering, Science and Technology at Portland State University is an example of zoning appropriately to meet the needs in various parts of the building.

Fig. 4

Push the Envelope

Glare control and control over radiant energy can be achieved through effective exterior wall

ne Appropriately

rder to appropriately zone a facility, it is critical to separate the lab spaces ı the non-lab spaces and then set levels of conditioning and control ordingly. The non-lab spaces represent opportunities to condition and ilate more efficiently.

ı-lab spaces can re-circulate air and labs can't. If you jumble them, it is actical to design systems to treat each differently," says Collins. "If these ıs aren't zoned differently, more energy is required. There is also the potential olate heavy heat load program elements on a process chilled water loop in r to avoid designing the entire supply air system for a unique point load."

ry clear distinction is noted between the lab areas and the non-lab areas in design for the Li Ka-Shing Center at UC Berkeley. In particular, the lab ilation requirements are decoupled from the cooling requirements. The gn also takes into consideration the comfort of occupants while providing a working environment.

Northwest Center for Engineering, Science and Technology at Portland State versity displays a noticeable distinction between the different functional ıs of the building. For example, in a stairwell area, a stack effect is created re cooler air comes in at the bottom and warmer air is exhausted at the top to advantage of natural ventilation.

ing appropriately came easy at the Marine Sciences Building at the versity of California, Santa Barbara where the building occupants want to be nected with the outside environment. In their offices and some other non-lab ıs, researchers prefer operable windows and the natural ventilation afforded he building's design.

sh the Envelope

architects, we want to think carefully about the enclosure of the buildings we gn and make sure we are capitalizing on climatic forces and what nature vides," says Collins. "For instance, we want to look at the sun and how it cts the building in terms of where it might provide high heat load and how the ntation and massing of the building can help overcome that."

essential to utilize strategies that will reduce electrical load, as well as te visual and thermal comfort, especially when 90 percent of operating costs directly related to staff. Glare control and control over radiant energy from the elope can be accomplished through effective exterior wall design, which imizes natural ventilation and daylighting in the appropriate zones. The UC ta Barbara, Bren School of Environmental Science and Management uses rior screening devices to provide shading and to help direct natural breezes.

design for the Li Ka-Shing project utilizes a corridor as a buffer zone veen the high western solar loads and the research space.

r environmental considerations include air quality—how clean or dirty is nd its corrosive effects. Facilities at the University of California, San Diego Santa Barbara must consider materials to deal with the effects of salt in the

re is this romantic idea of being one with the environment," says Collins. "As gners and engineers it is our job to make a building actually work with the ronment and not cause additional problems to any extent possible."

ucture for Daylighting

exterior walls should be designed to take full advantage of available ight. Higher window head heights make deeper daylight penetration sible, requiring less artificial lighting for ambient illumination. Adjustable ior shading devices can be used to control glare.

use a rule of thumb of about two to 2 ½ times the height of glass on the rior wall as the effective depth of penetration for daylighting," explains ins. "Lighting can be eight to 20 percent of the total electrical load. If you at the total cost of owning and operating a building over its lifetime the tal cost to build it is about two or three percent. Most of the money goes into t it takes to pay people to live and work in that building. If you can achieve a r 20 percent increase in efficiency or retention of staff, that pays big lends and access to natural light is a significant part of that equation."

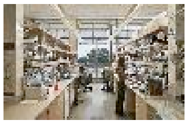
ing height, the location of main duct runs, and the structure on the building's rior must be considered when designing to optimize use of daylighting. If s can be moved to the center of the building where the ceiling height is lower the perimeter beams can be turned up, thereby allowing high fenestration for story below, it is possible to achieve the same level of daylighting with lower -to-floor heights.

labs at the Leichtag Center at the University of California, San Diego are led with natural light admitted through full-story glazing and a ceiling that es upward to receive it. Exterior screening is utilized on the south facade to rol glare. An atrium at Stanley Hall at UC Berkeley provides plenty of natural into the heart of the building. Adjustable natural wood louvers and shading used to manage glare.

e are going to be good stewards of the environment, we have to take a more

design which maximizes natural ventilation and daylighting. The UC Santa Barbara, Bren School of Environmental Science and Management demonstrates a design that capitalizes on climatic forces.

Fig. 5



Daylighting

The labs at the Leichtag Center at the University of California, San Diego are flooded with natural light admitted through full-story glazing and a ceiling that slopes upward. (Photo courtesy of Joe Collins, Zimmer Gunsul Frasca Architects LLP.)

stic approach in designing buildings," says Collins. "As designers who are ous about designing sustainable labs, we need to hit energy efficiency really l."

xt in the Series

art II of this series, Paul Mathew, a staff scientist at Lawrence Berkeley onal Laboratory, will discuss the remaining five strategies for achieving imum energy efficiency by including specific design features in the planning cademic science buildings. The article will discuss scrutinizing air nges, using low-pressure drop design strategies, avoiding the unnecessary rsizing of systems, steering clear of systems that require simultaneous ting and cooling, and commissioning the building to ensure it is operating as nded.

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velcome your Questions and Comments

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